THE PLANT DISEASE REPORTER

Issued By

THE PLANT DISEASE SURVEY

Division of Mycology and Disease Survey
BUREAU OF PLANT INDUSTRY, SOILS, AND AGRICULTURAL ENGINEERING
AGRICULTURAL RESEARCH ADMINISTRATION
UNITED STATES DEPARTMENT OF AGRICULTURE

Volume 32 Number 11

November 15, 1948

The Plant Disease Reporter is issued as a service to plant pathologists throughout the United States. It contains reports, summaries, observations, and comments submitted voluntarily by qualified observers. These reports often are in the form of suggestions, queries, and opinions, frequently purely tentative, offered for consideration or discussion rather than as matters of established fact. In accepting and publishing this material the Division of Mycology and Disease Survey serves merely as an informational clearing house. It does not assume responsibility for the subject matter.

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Plant Industry Station - Beltsville, Maryland
Volume 32 November 15, 1948 Number 11

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COTTON SEED TREATMENT TESTS AT THE U. S. COTTON FIELD STATION, SHAFTER, CALIFORNIA

Scott C. McMichael and L. A. Brinkerhoff

The four tests reported in this paper were conducted on a sandy loam soil under field conditions using Acala P18-C, the commercial variety of cotton in California during the time of the tests.

Tests conducted in 1941, 1942, and 1943 were designed to compare: (1) different disinfectant dusts, (2) recently treated seed with seed that had been treated and stored one year, (3) reginned, acid delinted, and fuzzy seed. Ceresan and New Improved Ceresan were used all three years, whereas Spergon was used only in 1943 and to a limited extent in 1942. The dusts were applied according to the manufacturer's recommendations at the rates shown in table 1. Acid delinted seed was not included with the stored lots in 1941. Plots consisted of single rows 100 feet long and were planted with 100 seeds hand-dropped through a two-row cotton planter. Seedlings were counted and removed at regular intervals during the period of emergence. Thus post-emergence damping-off was not taken into consideration. The planting dates were as follows: April 4, 1941; March 23, 1942; and March 31, 1943.

Table 1. Dosages of disinfectant dusts used in the 1941, 1942, and 1943 tests

Dust	Ounces of dust per 100 lbs. of cotton seed	
	Fuzzy	Delinted[a]
Ceresan	9.0	6.0
New Improved Ceresan	4.5	2.0
Spergon	15.0	9.0

[a] Both reginned and acid delinted seed received the same amount of dust.

The fourth test was conducted in 1948. It consisted of 12 treatments replicated nine times and was conducted in much the same manner as the previously described tests. A number of different dusts were compared on fuzzy and coated seed. The coating for the latter consisted of a thin layer of clay-like material which covered the fuzz and resulted in a fairly hard smooth seed[1]. In each instance the disinfectant dust was incorporated into the coating material. One lot of acid delinted seed

[1] The seeds were coated by the Filtrol Corporation of Los Angeles, California under the direction of Mr. F. W. Burgesser.

was also included in the test. The disinfectants were applied at the rate of 4 ounces per 100 pounds of seed, except New Improved Ceresan and Bioquin 1 which were both applied at one-half that rate. The planting date was April 1, 1948.

The active ingredient of the various dusts used in the four tests are listed in table 2.

Table 2. Disinfectant dusts.

Dust	Active ingredient	Manufacturer
Ceresan	2% ethyl mercury chloride	E. I. Du Pont De Nemours & Co.
New Improved Ceresan	5% ethyl mercury phosphate	" "
Ceresan M (1452-F)	7.7% ethyl mercury p-toluene sulfonanilide	" "
Arasan	50% tetramethyl thiuramdisulfide	" "
Dow 9B	50% Zn 2-4-5 trichlorophenate	Dow Chemical Co.
Spergon	98% tetrachloro-para-benzoquinone	U. S. Rubber Co.
Phygon	88% 2,3-dichloro-1,4-naphthoquinone	" "
Bioquin 1	100% copper 8-quinolinolate	Monsanto Chemical Co.

The 1941 and 1942 tests show significant differences between dusted and undusted seed, tables 3 and 4. Plots treated with New Improved Ceresan gave higher emergence rates than with Ceresan; however, the difference in effectiveness between the two materials was not highly significant. Spergon was hardly as effective as the other dusts in the 1942 test. The data, however, are not sufficient to evaluate this material.

No significant differences between disinfectants were obtained in either the 1943 or the 1948 test. In both instances the percentage of emergence was relatively high throughout. See tables 3, 4, and 5.

The results of storage treatments are not conclusive. The unstored seed germinated better in 1941, while the stored seed was significantly better in 1942. Only a very slight difference was noted in 1943. Possibly the difference between 1941 and 1942 can be attributed to origin or age of the seed rather than to storage treatment. In each test the stored seed was produced one season earlier than the unstored seed.

In 1942 the acid delinted seed produced 8 percent more seedlings than reginned seed; fuzzy seed was intermediate between acid delinted and reginned seed. The only other instance in which a significant difference occurred between kinds of seed was in the 1948 test when acid delinted seed produced about 10 percent more seedlings than either coated or fuzzy

Table 3. Comparison of cotton seed treatments for three years at the U. S. Cotton Field Station, Shafter, California

Kind of seed and treatment	Years 1941	1942	1943
	Seedling emergence		
	Percent	Percent	Percent
I. Treated immediately before planting[a]			
A. Fuzzy			
1. Check	38.5	68.3	84.3
2. Ceresan	57.5	73.3	87.5
3. New Improved Ceresan	60.3	75.5	80.8
4. Spergon	-	66.3	85.0
B. Reginned			
1. Check	42.7	61.3	81.5
2. Ceresan	54.0	63.8	82.5
3. New Improved Ceresan	64.7	68.7	84.8
4. Spergon	-	63.8	83.3
C. Acid delinted			
1. Check	38.3	73.0	89.5
2. Ceresan	53.2	82.2	84.3
3. New Improved Ceresan	58.7	82.5	86.8
4. Spergon	-	79.2	83.2
II. Treated and stored 1 year[b]			
A. Fuzzy			
1. Check	33.0	73.5	86.7
2. Ceresan	49.7	83.3	86.2
3. New Improved Ceresan	50.2	86.5	84.8
4. Spergon	-	-	83.2
B. Reginned			
1. Check	35.5	76.5	85.0
2. Ceresan	47.8	83.7	86.2
3. New Improved Ceresan	48.7	81.3	88.2
4. Spergon	-	-	85.5
C. Acid delinted			
1. Check	-	76.3	85.5
2. Ceresan	-	83.2	87.0
3. New Improved Ceresan	-	86.5	84.8
4. Spergon	-	-	82.7
LSD - 1%	13.2	11.9	8.2

[a] Seed grown one season previous to planting.
[b] Seed grown two seasons previous to planting.

Table 4. The effect of chemical dusts, kinds of seed, and storage of treated seed on cotton seedling emergence for the 1941, 1942, and 1943 tests at Shafter, California. Factorial summary of table 3.

	Years		
	1941	1942	1943
	Seedling Emergence		
	Percent	Percent	Percent
Chemicals			
None	37.4	71.5	85.4
Ceresan	52.3	78.2	85.6
New Improved Ceresan	56.0	80.2	85.3
Spergon	-	-	83.8
LSD-1%	6.4	4.9	3.3
Kinds of Seed			
Fuzzy	48.2	76.7	84.8
Reginned	48.9	72.6	84.8
Acid delinted	-	80.6	85.5
LSD-1%	5.2	4.9	2.9
Storage after treatment			
None[a]	52.9	72.1	84.5
1 year[b]	44.1	81.2	85.6
LSD-1%	5.2	4.0	2.4

[a] Seed grown one season previous to planting.
[b] Seed grown two seasons previous to planting.

seed. See table 5. This difference, however, may have been due to the removal of the floating seed at the time the delinted seeds were washed. The floating or light fraction amounted to 11.8 percent of the seed on a weight basis and contained the shriveled and poorly developed seeds. Some seed, however, of good viability were also removed with this fraction.

Table 5. Comparison of cotton seed treatments. U. S. Cotton Field Station, Shafter, California, 1948

Treatment	Seedling emergence as percentage of seeds planted
A. Fuzzy	
1. Check	79.4
2. Dow 9-B	81.6
3. Ceresan M	84.3
4. Spergon	80.6
5. Bioquin 1	82.8
6. Phygon	77.9
B. Coated	
1. Check	78.9
2. Dow 9-B	77.3
3. Arasan	80.3
4. Spergon	82.3
5. New Improved Ceresan	81.6
C. Acid delinted	
1. New Improved Ceresan	89.8
LSD-1%	7.2

A summary of daily weather observations for the first ten days after planting for the four tests shows considerable variation for minimum air temperatures. The two tests in which seed treatments were beneficial (1941 and 1942) had lower minimum air temperatures than the two tests which showed no benefit. This is shown by the following averages: 1941, 44.7° F.; 1942, 39.6° F.; 1943, 48.4° F.; 1948, 47.5° F. The differences between minimum air temperatures become smaller, however, when taken for 14 days or longer. Averages for maximum daily air temperatures for the first ten days after planting show very little variation: 1941, 1942, and 1948 all averaged approximately 66 degrees, while the 1943 test averaged 68 degrees. Rainfall in inches for the same period was as follows: 1941, 1.40; 1942, 0.0, 1943, 1.05; 1948, 0.52.

The results of the four tests may be summarized briefly as follows: Significant differences between chemically dusted and undusted seed were

obtained in two of the tests, 1941 and 1942, under conditions which favored relatively poor germination for the untreated seed. When conditions were apparently favorable for germination as in the 1943 and 1948 tests the dusts were of no benefit. Under very adverse conditions as in 1941 only slightly more than one-half of the treated seed produced seedlings.

Treated stored seed gave equal or better germination in 1942 and 1943, but yielded significantly fewer seedlings in 1941. The differences between the stored and unstored seed may have been due to age or origin of the seed rather than to treatment.

Acid delinted seed produced a higher percentage of seedlings in two of the tests. There were no other significant differences between kinds of seed.

DIVISION OF COTTON AND OTHER FIBER CROPS AND DISEASES, UNITED STATES DEPARTMENT OF AGRICULTURE

PHYTOPHTHORA CINNAMOMI ASSOCIATED WITH THE ROOTS OF LITTLELEAF-DISEASED SHORTLEAF PINE

W. A. Campbell

Littleleaf is a widespread and locally serious disease of shortleaf pine (Pinus echinata Mill.) in the Southeast. Extensive root necrosis and general foliage symptoms suggest that the primary cause may be some root-killing pathogen or pathogens. However, thousands of isolations from large and small roots by conventional agar plate methods failed to produce a single recognized root pathogen.

In March 1948, following an exceptionally wet winter, roots one-eighth inch in diameter and smaller were cultured for watermolds, by the technique described by Crandall[1]. The apple technique described by Tucker[2] was used for the differential isolation of Phytophthora spp. A Phytophthora identified as P. cinnamomi Rands was isolated from the roots of a diseased tree near Athens, Georgia. Later in August 1948 other isolates of the same fungus were obtained from diseased trees near Carnesville and Elberton, Georgia and Walhalla and Abbeville, South Carolina.

The association of P. cinnamomi with the fine roots of littleaf-diseased shortleaf pine is particularly interesting in view of Copeland's[3] observations that the disease is most serious on soils with poor internal drainage. Further isolations and inoculation studies are now underway to determine the role of P. cinnamomi and other parasitic water molds, if any, in littleleaf disease.

DIVISION OF FOREST PATHOLOGY, BUREAU OF PLANT INDUSTRY, SOILS, AND AGRICULTURAL ENGINEERING, U.S.D.A., IN COOPERATION WITH SCHOOL OF FORESTRY, UNIVERSITY OF GEORGIA, ATHENS, GEORGIA

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1 Crandall, B. S. Phytophthora cinnamomi root rot of avocados under tropical conditions. Phytopath. 38: 123-130. Illus. 1948.

2 Tucker, C. M. Taxonomy of the genus Phytophthora de Bary. Missouri Research Bull. 153. 208 pp. Illus. 1931.

3 Copeland, O. L. Some relations between soils and the littleleaf disease of pine. 4 pp. Manuscript to be submitted to Journal of Forestry.

NEMATODES AS A DISTURBANCE FACTOR IN GREENHOUSE, PLOT AND FIELD EXPERIMENTS

Gerald Thorne

Investigators familiar with the plant nematode problem have long known that plant pathogenic nematodes may be a serious disturbance factor in greenhouse, plot, and field experiments. Unfortunately experimenters from other lines of work (e.g. plant breeding, crop testing, fungicide, insecticide, fertilizer testing) are not infrequently unaware or forgetful of this fact. Root attacking nematodes in particular may seriously influence the behavior of test plants and may sometimes completely upset and confuse results. Again and again observations have evidenced these facts and the following examples point to the need of careful consideration of plant nematodes in planning and executing experimental work involving soils exposed to nematode infestations.

Recently an elaborate series of experiments had been planned on fertilizers, irrigation and spacing as related to the production of sugar beets. The test fields had been tentatively selected. Fortunately it was suggested that before planting the land should be checked for the presence of the sugar beet nematode. A nematologist then demonstrated the presence of this pest in all the fields under consideration but particularly to a serious degree in the most favored one.

The above well illustrates the hazards of selecting experimental sites and soils without a previous check on the presence of plant pathogenic nematodes. Results of long range crop rotation and fertilizer experiments on infested fields may also be falsified by interference of nematodes, this often to such a degree that the value of such tests from the standpoint of the original objectives is nil or highly disputable.

Experiment Station lands are particularly exposed to becoming infested with nematode pests since knowingly or unknowingly, infected nursery stock, seedlings and other plants are frequently introduced. Following are instances observed by the writer which give some idea as to the magnitude and variety of the problems encountered:

a. Alfalfa stands failed to become well established, the root systems were branched and spreading and few long tap roots were developed. In plots plowed up after 4 or 5 years less than 10 percent of the roots were found to be growing deep enough to be cut off by the plow. After many years of work on this Station it was discovered that root knot nematodes were, at least to a large extent, responsible for the existing conditions. The young seedlings were attacked early in life and tap root production practically eliminated. As the tap roots were destroyed, laterals were produced and these in turn were attacked and still further

stunting and multiplication of roots followed. Yields were sometimes only two tons per acre where six tons should have been produced.

b. A series of crop rotation plots had been established over 30 years but many of the crops did poorly because root knot nematodes were present on certain areas. This was not realized until portions of certain plots were fumigated with the result that more vigorous and healthy growth was obtained on the fumigated areas.

c. Alfalfa, clover and grain grown in a series of rotation plots did poorly; finally the cause was traced to heavy populations of a species of Pratylenchus, a meadow nematode. Many of the feeder roots were killed and severe lesions produced on the larger ones, making it possible for fungi and bacteria to enter the root tissues and thereby complicate the situation by multiple infection.

d. Slow decline of citrus for many years was studied from the standpoint of soil fertility and element deficiency, only to be linked finally with enormous populations of the citrus nematode, Tylenchulus semipenetrans. This same nematode, or a very closely related species, has also been found causing a similar puzzling slow decline of olive trees in two localities.

e. Apple trees suffering from a baffling slow decline were finally also discovered to be infected with a species of Pratylenchus. Figs, walnuts, cherries and almonds too were found attacked to a serious degree by various species of this genus. Slow decline or retarded growth coupled with root lesions and dying rootlets are the common symptoms of such infections.

f. Fig trees which suffered premature leaf and fruit drop were discovered to be infected by myriads of Paratylenchus, probably P. macrophallus or a closely related species, as well as by an undescribed species of Xiphinema. These long speared species were puncturing cells of the feeder rootlets causing a corky, hypertrophied condition which eventually resulted in root-destruction. Soil samples taken from around these trees were filled with fragments of the dead roots, a condition frequently associated with infections by root inhabiting nemas.

g. Experimental plots of cotton were found by the Station operator to be generally infected with root knot nematodes, but he was able to maintain normal yields by following a rigorous program of crop rotation and fallow.

h. Strawberry plots were found to be suffering from severe infections of both root knot nematode and a species of Pratylenchus.

i. Slow decline in an orchard of walnuts on seedling Mayette root

stocks was finally discovered to be associated with an infection of the root parasitic nematode, Cacopaurus pestis, instead of a deficiency in soil fertility which was first assumed.

It is very doubtful if a plot or field can be selected which is not inhabited by one or more species of root feeding nemas. Many of these species do not enter the root tissues as do root knot and Pratylenchus, but attach themselves to the roots and feed on the cell contents by inserting their spears. In some instances, e.g. Cacopaurus and Paratylenchus, the salivary secretion injected into the root-cell causes hypertrophy and eventual death of the tissues; in fact, it is probable that any nematode which feeds on the root cells causes some damage other than the mechanical puncturing of the cell wall.

The usual "stimulation" secured from soil fumigation is without doubt due, at least in part, to the destruction of unrecognized nematode pests, as previously noted by various writers. Investigators appear hesitant to use fumigation because of this "simulation" but is it not better to be certain of normal, thrifty growing plants than to attempt to balance the injury from nematodes by adding fertilizers and irrigation water? The writer predicts that, as we learn more about the intricate details of what takes place in the soil when we use the various fumigants, we will eventually use fumigation as a standard practice in practically all plot and field experimental work, and that data from experiments conducted without such preliminary practices will be subject to question. Many problems remain to be solved as to the proper time for such fumigation: Must it be in the spring, in the fall, or during the previous year? Will the procedures found successful for the dichloropropenes be applicable to the ethylene dibromide mixtures or chloropicrin and other products? Will it be possible to combine nematocides, insecticides and fungicides? The possibilities are almost without limit. Let us hope that we shall soon see preliminary pilot tests on every experimental field.

DIVISION OF NEMATOLOGY

SOIL TREATMENTS WITH NEW INSECTICIDES INEFFECTIVE IN CONTROL OF ROOT-KNOT

D. E. Ellis and C. N. Clayton

Several chemicals with high insecticidal properties were used at various dosages in a preliminary test in 1948 to determine their potential value as soil treatment materials for control of root-knot. Benzene hexachloride in a 1947 test[1] was ineffective. Under the conditions of the test described below benzene hexachloride, DDT, Parathion, Chlordane, and chlorinated camphene failed to reduce appreciably the incidence of root-knot.

The treatments including the materials and the dosages used are given in Table 1. Twelve untreated plots were used as controls. The plot size was .001 acre. Two replicates of each treatment were used. The test was made on sandy loam soil low in organic matter and heavily but irregularly infested with the root-knot nematode. All roots and root-knot galls from the previous crop had completely decayed. At the time of treatment the soil conditions were optimum for planting. On April 29, 5-10-5 fertilizer at rate of 1500 lbs. per acre was broadcast and disked into the soil. On April 30, the insecticides were suspended in water in a 2-gallon can and sprinkled uniformly on the soil, which was immediately spaded approximately 6 to 8 inches deep.

One week after treatment 100 snap bean and 100 okra seeds were planted in 3-foot rows in each plot. A second planting was made a month after treatment. Stand counts, vigor ratings, and yield data were taken. These data will not be presented here. However, there was some indication of phytotoxicity in plots treated with Chlordane, Parathion, and benzene hexachloride at the higher rates. The lack of uniformity in the incidence of root-knot complicated observations and interpretations of data upon relative vigor and yield as affected by the different treatments.

The roots of the plants were examined and rated for root-knot. The maximum index for each treatment is shown in Table 1. In one or more replications of each treatment the root-knot index approached or, in most cases, was as high as that of the untreated plots. Although close comparisons of the relative effects of the different rates of application could not be made, the results did indicate that root-knot was not appreciably affected by any of the materials used.

Some chemicals applied to soil are known to be taken up by the plant and to affect the taste and odor of the aboveground parts of the plant. Snap beans from the plots treated with the highest dosage of each material were steamed in cotton-plugged flasks. Those from plots treated

[1] Clayton, C. N. and D. E. Ellis. Benzene hexachloride fails to control the root-knot nematode. Plant Dis. Rptr. 31: 487-489. 1947.

Table 1. Effect of soil treatment with insecticidal materials at various dosages upon the incidence of root-knot of okra and snap bean.

Treatment Material	Pounds per acre	Root-knot index
Benzene hexachloride (6% gamma isomer	33	63
	99	100
DDT (50% wettable)	33	100
	99	100
Parathion (25% wettable)	11	92
	33	88
	99	66
	297	93
Chlordane (50% wettable)	11	100
	33	96
	99	81
	297	100
Chlorinated camphene (40%)	11	100
	33	96
	99	100
	297	100
Untreated (control)		100

with benzene hexachloride or with Chlordane had definitely a disagreeable odor. After cooling and storage at 25° C. for 24 hours, the disagreeable odor of benzene hexachloride was still present.

About four months after treatment two rows of cowpeas were planted on each plot after the beans and okra were removed. Uniformly good stands were obtained. In early October marked differences in vigor, size and number of plants on the various plots were apparent. A rating of the relative stands and vigor of plants on each plot was made on a scale from 0 to 10 (0 = no plants; 1 = very poor stand of plants about 2 to 3 inches high; and 10 = excellent stand of healthy-appearing plants about 12 inches high). The average rating for the untreated plot was 0.9. At the lowest dosages of most materials the ratings averaged about the same as for the check. However, the rating was 4.0 or above for Parathion at 33, 99, or 297 pounds per acre; for benzene hexachloride at 99 pounds; and for Chlordane and chlorinated camphene at 297 pounds per acre. Examination of the cowpea roots showed that these differences were not the result of root-knot which was quite severe on practically all the plots.

PLANT PATHOLOGY SECTION, NORTH CAROLINA AGRICULTURAL EXPERIMENT STATION, RALEIGH, NORTH CAROLINA

CLADOSPORIUM SPOT OF COWPEA IN SOUTHERN CALIFORNIA

J. B. Kendrick, Jr. and John T. Middleton

During the late summer of 1947 specimens of diseased cowpea, Vigna sinensis, plants were received from Orange County in California for examination. Numerous lesions occurred on the peduncles and pods as well as on the seed. Peduncle lesions were elliptical, somewhat sunken with a tan center and a dark reddish-brown border. Pod lesions were similar to the peduncle lesions in color, but were irregularly oval in shape. Infected pods were misshapen with some lesions occurring at points of curvature. Seed lesions were sunken, somewhat oval, with a dark brown border and tan center. On the surface of all lesions there occurred abundant sporulation of a fungus identified as Cladosporium. Repeated isolations from this material yielded an organism resembling Cladosporium vignae Gardner. Measurements of the conidia and conidiophores as well as the morphology and fruiting habit agree with the original type description by Gardner[1]. M. W. Gardner confirmed the identification upon examination of diseased material and cultures of the organism.

Infected seed secured from the original collection were sown in pots containing sterilized soil and placed in the greenhouse. The seedlings obtained showed typical seedling infections of elongated buff-colored lesions with dark brown margins on the stems in every case. This demonstrates that the disease can be seed-borne as indicated by Gardner.

In August of this year, 1948, additional cowpea material was received from Mr. R. J. Bumgardner, Deputy Agricultural Commissioner in Orange County. The material represented four different non-adjacent fields planted with seed from two sources. Symptoms were similar to those seen in 1947 and Cladosporium vignae was again isolated.

Weather and growth conditions apparently were ideal both years for the development of this organism. In 1947 the affected plants exhibited rank growth. There was a considerable amount of foggy weather during the period when the pods were developing. The abundant growth together with the excessive dampness combined to maintain sufficient moisture for growth and distribution of the fungus. Again in 1948 relatively cool and foggy weather persisted during the period of pod formation, thus favoring the development of the disease which apparently was introduced by contaminated seed stock.

So far as the writers are aware this is the first record of Cladosporium spot occurring in California.

UNIVERSITY OF CALIFORNIA, CITRUS EXPERIMENT STATION, RIVERSIDE

[1] Gardner, Max W. Cladosporium spot of cowpea. Phytopath. 15: 453-462. 1925.

THE PURE LINE OR VARIETY CONCEPT WITH RESPECT TO DISEASE RESISTANCE IN PLANTS

C. C. Wernham

Parris (PDR 32: 378-379. 1948) has recently called attention to the irregular behavior of F_1 plants in crosses of wilt-resistant and wilt-susceptible watermelons grown on wilt-infested soil. The literature on disease resistance in plants is liberally sprinkled with similar data, regardless of the crop investigated.

Since a working hypothesis is necessary in any well conducted breeding experiment such data give us a choice of several assumptions: (1) the soil is not homogeneously infested allowing escapes to survive; (2) edaphic factors conditioning infection are not uniform throughout the plot; (3) the population (F_2) is not large enough for adequate genetic analysis; (4) complementary factors or a complex type of inheritance are involved; or (5) the parents of the cross are impure for the reaction. The latter assumption apparently is the one that gets least attention.

Of the seven variety or inbred line reactions reported by Parris, only one, "Cletex", seems to be pure for disease reaction (complete susceptibility). From a genetic viewpoint Cletex is the only homozygous variety used in the experiment. Unless one can subscribe to assumptions 1 and 2, the only remaining conclusion is that the others are heterozygous which, in turn would account for the variability in the F_1 generation.

If plant pathologists are forced by circumstances to become the plant breeders, responsible for disease-resistant varieties, they may as well face the fact that varieties and inbred lines are not always pure for disease reaction, but are aptly described by the better informed breeders as being relatively homozygous for certain characters under observation for a number of years. Unless linkage is a factor, the genetic constitution for other characters is a matter of chance.

For any single factor pair the F_2 ratio of homozygotes to heterozygotes is 1:1. As long as the assortment is independent, the ratios for additional factors can be obtained by the binomial expansion $(1 \text{ plus } 1)^n$ as shown on the following page.

From the table it can be seen

1. That the number of complete heterozygotes is always equal to the number of complete homozygotes, i.e., any time a homozygous individual may be selected, the chances are equal that a complete heterozygote may be chosen.

Formula if the number of independent factor pairs involved is	Frequency distribution of odds for individuals in first segregating generation heterozygous for: 0 pairs	1 pair	2 pairs	3 pairs	4 pairs	5 pairs	n pairs	Theoretical minimum F_2 populations
$1-(1+1)^1$	1	1						4
$2-(1+1)^2$	1	2	1					$(4)^2$
$3-(1+1)^3$	1	3	3	1				$(4)^3$
$4-(1+1)^4$	1	4	6	4	1			$(4)^4$
$5-(1+1)^5$	1	5	10	10	5	1		$(4)^5$
$n-(1+1)^n$	1	$^nC_1$*	$^nC_2$	$^nC_3$	$^nC_4$	$^nC_5$	^nC_n	$(4)^n$

* The number of combinations of "n" things one at a time,

thus $^nC_3 = \frac{n(n-1)(n-2)}{1 \times 2 \times 3}$

2. That as the number of factor pairs governing a reaction increases, the chance of selecting intermediates increases also.

Suppose three factor pairs are involved. The chances of selecting an individual heterozygous for one or more pairs are 7:1. Assume that plants chosen may be represented by the formulae (a) AA bb Cc, or (b) aa Bb Cc. In the F_3 the chances of selecting heterozygotes from (a) are 1:1; from (b) 3:1, i.e., two chances for choosing plants heterozygous for one pair plus one chance for selecting plants heterozygous for two pairs as against one chance for choosing homozygous individuals.

Thus, as long as individual plants are selected to continue lines, heterozygotes may be selected indefinitely, especially if the number of factor pairs remains small.

But varieties and inbred lines are ultimately established by bulking the seed from the progeny of certain individuals. This process insures without doubt the continuity of any heterozygosis still existing in the progeny.

From a practical point of view what does it matter if 5 percent of the population is defective? Under conditions of severe wilt the homozygous susceptibles will die off and seed will not be produced. But if they die after flowering rather than before, their pollen will have been carried to other individuals to produce either heterozygotes or homozygous susceptibles. Where resistance behaves as a dominant and cross pollination is the mode, the recessives are always in the minority in such populations.

From the standpoint of genetic analysis however, it is difficult to arrive at convincing ratios with small numbers unless the parents give a constant reaction under epiphytotic conditions. It would appear from the data reported above that there is need for extensive progeny testing of the resistant varieties.

DEPARTMENT OF BOTANY, PENNSYLVANIA STATE COLLEGE, STATE COLLEGE

PLANT DISEASES RECORDED FROM NEW LOCATIONS

RUST ON PEANUTS IN LOUISIANA

by A. G. Plakidas

I wish to report the occurrence of rust, Puccinia arachidis Speg., on peanuts in Louisiana. As far as our files show, this is the first that this disease was found in Louisiana, although sporadic appearances of it have been recorded from Florida, Georgia and Texas, and probably from other States. The disease was found in Baton Rouge on October 7. It was limited to one spot of about 8 feet long at one end of a 200-foot row. The affected plants were badly "rusty" and defoliated, illustrating the potential destructiveness of this disease. Only uredospores were found in the sori.

LOUISIANA AGRICULTURAL EXPERIMENT STATION

BRIEF NOTES ON PLANT DISEASES

CHARCOAL ROT IN PEPPER ROOTS

by P. A. Young

Five fields of the California Wonder variety of bell pepper (Capsicum frutescens L. var. grossum Bailey) near Troup, Texas, on September 5 and 7, 1948, showed from 1 to 20 percent of the plants to be wilting or dead with a disease with previously unknown cause. Cutting nearly 100 of the wilting plants with green stems showed numerous black sclerotia of the fungus, Sclerotium bataticola Taub., in the xylem of the bases of nearly all of the tap roots. Some of the sclerotia were spherical to oval and 15 to 75 microns in diameter. However, most of the sclerotia occurred in hard xylem tissue and these usually were elongate and 23 to 34 by 115 to 137 microns in dimensions. Typical spherical black sclerotia 45 to 60 microns in diameter were found in the pith of the bases of some dying branches of main stems. The symptoms of this disease of pepper ranged from slight wilting and drooping of the leaflets to defoliation and browning of the stems. Dead tap roots mostly showed large or small internal regions that were colored gray by the numerous black sclerotia in the xylem and pith cavities. This disease developed in the unusually hot and dry weather in August, which weather favors S. bataticola and retards the growth of peppers. Examination of three rows of Pimento peppers did not show any plants with charcoal rot so this variety appears to be resistant to this fungus. Martin (Phytopath. 7: 308-312. 1917) reported a fruit rot of pepper caused by S. bataticola. Higgins (Georgia Agr. Exp. Sta.

Bul. 141, in 1923) illustrated S. bataticola under the bark of a pepper stem.

TOMATO DISEASE LABORATORY, JACKSONVILLE, TEXAS

WILLOW SCAB IN NEW HAMPSHIRE

by M. C. Richards and A. R. Hodgdon

During the months of June and July the weather was favorable for the spread and development of Willow scab caused by Fusicladium saliciperdum (Venturia chlorospora). Large trees of white willow (Salix alba) along road sides were completely defoliated. Some of these trees which have been defoliated for the past three years have died this year.

In the town of Lee, New Hampshire, in an area covering about an acre eight species of willows were found. Readings on these eight species with respect to scab were as follows on July 15, 1948:

Salix alba - partial to complete infection and defoliation.
Salix bebbiana - trace of infection - slight to severe defoliation.
Salix cordata - trace of infection - 10 to 50 percent defoliation.
Salix discolor - no infection - 10 to 15 percent defoliation.
Salix lucida - severe infection - 10 percent defoliation.
Salix nigra - severe infection - 25 to 50 percent defoliation.
Salix pentandra - trace of infection - no defoliation.
Salix sericea - severe infection - 50 to 100 percent defoliation.

UNIVERSITY OF NEW HAMPSHIRE, DURHAM

CHECK LIST REVISION

Freeman Weiss

PAPAVERACEAE

ARGEMONE

ARGEMONE MEXICANA L., MEXICAN PRICKLY-POPPY (1); A. PLATYCERAS Link & Otto, CRESTED P. (2), other spp. (3). Perennial herbs of tropical America and southwestern U.S.A., adventive north and east and escaped from gardens where grown for ornament.

Aecidium plenum Arth. (0,I), rust. Tex. (3)
Alternaria lancipes Ell. & Ev., leaf spot. Tex. (1,2,3); Kans. (2)
Cercospora whetzelii Chupp, leaf spot. P.R. (1)
Cladosporium guanicensis F.L.Stevens, leaf mold. P.R. (1)
Gloeosporium argemonis Ell. & Ev., leaf spot. Tex. (1,2,3); Kans. (2)
Peronospora arborescens (Berk.) DBy., downy mildew. Tex. (1)
Phymatotrichum omnivorum (Shear) Dug., root rot. Tex. (1,2,3)
Septoria argemones Tharp, leaf spot. Okla. (1); Tex. (1,2,3); Nebr. (2)
S. chelidonii Desm. P.R. (1)

CHELIDONIUM (PAPAVERACEAE)

CHELIDONIUM MAJUS L., CELANDINE. Biennial herb of Europe, naturalized in the Eastern States, sometimes grown in wild gardens.

Phymatotrichum omnivorum (Shear) Dug., root rot. Tex.
Septoria chelidonii Desm., leaf spot. Tex.

DENDROMECON RIGIDA. See PDR 25: 132. 1941.

ESCHSCHOLTZIA (PAPAVERACEAE)

ESCHSCHOLTZIA CALIFORNICA Cham. (including numerous forms distinguished as races and varieties or sometimes spp.), CALIFORNIA-POPPY. Annual, or sometimes perennial, herb of sandy plains in Calif. and Ariz.; selected forms are widely grown for ornament.

Alternaria sp., collar rot. Tex.
Botrytis cinerea Pers. ex Fr., gray-mold blight. Alaska.

ESCHSCHOLTZIA cont.

Entyloma eschscholtziae Harkn., leaf smut. Calif.
Erysiphe polygoni DC., powdery mildew. Calif.
Heterodera marioni (Cornu) Goodey, root knot. Tex.
Heterosporium eschscholtziae Harkn., leaf mold. Calif.
Verticillium albo-atrum Reinke & Berth., wilt. Calif.
Xanthomonas papavericola (Bryan & McWhorter) Dowson, bacterial blight. Tex.

Yellows -- virus (Chlorogenus callistephi Holmes, Callistephus virus 1 K.M.Sm.). N.J., N.Y. Also var. californicus Holmes in Calif.

PAPAVER (PAPAVERACEAE)

PAPAVER NUDICAULE L., ICELAND POPPY (1); P. ORIENTALE L., ORIENTAL P. (2); P. RHOEAS L., CORN P. (3); P. SOMNIFERUM L., OPIUM P. (4); other spp. (5). Perennial (1,2) or annual (3,4) herbs, mostly of the Mediterranean region and s. Asia, except (1) in n. Eurasia and in arctic and alpine N. America; widely cult. for ornament (1,2,3), and (4) for oil and as source of opium (morphine).

Aphelenchoides fragariae (Ritz.-Bos) Christie, leaf nematode. ?N.J. (2)
Botrytis cinerea Pers. ex Fr., gray-mold blight. Alaska (1,3); Md., Wis. (2)
Cercospora papaveri Muller & Chupp, leaf and seed pod spot. Ala., ? Fla., Tex.
Entyloma fuscum Schroet., leaf smut. Iowa, Me. (1); Tex. (5)
Erysiphe polygoni DC., powdery mildew. Ore. (4)
Heterodera marioni (Cornu) Goodey, root knot.
Pleospora media Niessl, on stems. Alaska (1)
Rhizoctonia solani Kuehn, root and stem rot, damping off. Me., N.Y. (1); Ind., N.J. (2); Kans., N.J. (3); Ida. (4)
Septoria sp., leaf spot. Iowa (5)
Verticillium albo-atrum Reinke & Berth., wilt. N.Y. (2,5)
Xanthomonas papavericola (Bryan & McWhorter) Dowson, bacterial blight. Conn., Mo., N.J., N.Y., Ohio, Va. (2,3); Md. (4); Ore. (5)

Curly top -- virus (Chlorogenus eutetticola Holmes, Beta virus 1 K.M.Sm.). Tex. (1,2)
Spotted wilt -- virus (Lethum australiense Holmes, Lycopersicon virus 3 K.M.Sm.). Calif. (1)

SANGUINARIA (PAPAVERACEAE)

SANGUINARIA CANADENSIS L., BLOODROOT. Perennial herb of woodlands in the Eastern and Central States and southward, sometimes grown in wild gardens.

Botrytis sp., gray-mold blight. N.Y.
Cercospora sanguinariae Pk., leaf spot. Md., Mo., N.Y., Pa., Tex., Wis.
Cylindrosporium circinans Wint., leaf spot. Md., Mo., Wis.
Gloeosporium sanguinariae Ell. & Ev., leaf spot. Ohio, Tex.
Phyllosticta sanguinariae Wint., leaf spot. Mo., Tex., W.Va.
Pythium paroecandrum Drechs., root necrosis. Va.

PEDALIACEAE

SESAMUM

SESAMUM INDICUM L., SESAME. Tropical herb cult. for oil-bearing seed used in cookery and pharmacy; also naturalized in the far South and furnishes food for wildlife.

Cercospora sesami Zimm., leaf spot. Fla., Ga., S.Car., P.R.
Macrophomina phaseoli (Maubl.) Ashby, charcoal rot. Calif., Tex.
Pseudomonas sesami Malkoff, bacterial leaf spot. Kans., Tex.
P. solanacearum E.F.Sm., bacterial wilt. Ariz.

PHRYMACEAE

PHRYMA

PHRYMA LEPTOSTACHYA L., LOPSEED. Perennial herb of woodlands in the Eastern and Central States and southward; a wildlife food plant.

Cercosporella exilis J.J.Davis, leaf spot. Wis.
Puccinia extensicola Plowr. var. phrymae (Halst.) Arth. (O,I), rust. N.Y. to Nebr. and S.Dak. II and III on Carex spp.
Septoria leptostachyae Ell. & Kell., leaf spot. Vt. to Kans. and Minn.

PHYTOLACCACEAE

PHYTOLACCA

PHYTOLACCA AMERICANA L., POKEBERRY, POKEWEED (1). Coarse perennial herb of old fields and waste ground throughout the Eastern and South Central States; collected for edible greens and a wildlife food plant. Other spp. (2) of tropical America or e. Asia are of similar utility.

PHYTOLACCA cont.

Alternaria sp., leaf spot. N.Y., Tex., Wis.

Asteroma spp., on stems. N.Car., Pa. Several reputed fungi described by Schweinitz under Dothidea (D. crustacea, D. elegans and D. inelegans), by Saccardo under Phyllachora, are referred to this genus by M. A. Curtis. Their nature and significance are unknown.

Cercospora flagellaris Ell. & Martin, leaf spot. N.J. to Fla., Ill., and Tex. (1); P.R. (1,2)

Diaporthe arctii (Lasch) Nits. (D. aculeata (Schw.) Sacc.), on dead stems. N.J. to Ala. and Ky.

Heterodera marioni (Cornu) Goodey, root knot. Ala., Tex. (1); Hawaii (2)

Phomopsis phytolaccae (Berk. & Curt.) Grove, on stems. N.J. to Ala. and Ky. Probably the conidial stage of Diaporthe arctii.

? Phyllachora spp., on stems. N.Car., Pa. See Asteroma. P. phytolaccae (Schw.) Sacc., described as sterile, and believed by Ellis and Everhart to belong to Asteroma, has not been confirmed as of fungous origin.

Phyllosticta phytolaccae Cke., leaf spot. Ala., N.J., S.Car.

Phymatotrichum omnivorum (Shear) Dug., root rot. Tex.

Rhizoctonia crocorum (Pers.) DC. ex Fr., root rot. Tex.

R. solani Kuehn, root rot. Fla.

Septoria phlyctaenoides Berk. & Curt., leaf spot. N.J., N.Y., Ohio (1)

Uredo panamensis Arth. (II), rust. Canal Zone (2)

Mosaic -- virus(es). In part Marmor cucumeris Holmes, Cucumis virus 1 K.M.Sm., reported in Ill., Ind., Mich. (1); Fla. (2); more commonly a different, unidentified virus, of general occurrence (1)

Ring spot -- virus (Marmor annualarium McK., nicotiana virus 12 K.M. Sm.) Va. (1)

RIVINA (PHYTOLACCACEAE)

RIVINA HUMILIS L., ROUGE-PLANT. Perennial herb of tropical America, grown for ornament under glass or in the open in the far South.

Cercospora flagellaris Ell. & Martin, leaf spot. Fla., Tex., P.R.

Puccinia raunkiaeri(i) Ferd. & Winge (0,I,II,III), rust. Fla., Tex., P.R., Virgin Is.

Rhizoctonia crocorum (Pers.) DC. ex Fr., root rot. Tex.

PLANTAGINACEAE

PLANTAGO

PLANTAGO spp., PLANTAIN. Weedy herbs, in part annual and native to plains and prairies in the Central and Western States, as P. ARISTATA Michx. (1) and P. PURSHII R. & S. (2) or in the East as P.

PLANTAGO cont.

VIRGINICA L. (3); in part perennial, native or introduced, as P. LANCEOLATA L. (4), P. MAJOR L. (5), and P. RUGELII Dcne. (6); others of seacoasts and marshes as P. ERIOPODA Torr. (7) and P. MARITIMA L. (8); other spp. (9). Several are important wildlife food plants.

Aphysa plantaginis (Ell.) Theiss. (Asterina plantaginis Ell.) on leaves. Calif., Ill., Md., N.J., Pa., Va. (5); Vt., Wis. (6)

Ascochyta plantaginella Tehon, leaf spot. Ill. (6).

A. plantaginis Sacc. & Speg. Okla. (1,5)

Cercospora plantaginella Tehon, leaf spot. N.Car. (4); Ill. (6)

C. plantaginis Sacc. Me. to Ala. and Kans. (4,5); Ind., Wis. (6); Hawaii (9)

Ditylenchus dipsaci (Kuehn) Filip., stem and leaf nematode. N.Y. (4,6); Ore. (8)

Erysiphe cichoracearum DC. (E. lamprocarpa Kichx.), powdery mildew. Tex. (1,4,9); N.Car. (4); N.Y. to Miss., Colo., and Wash. (5); N.Y. to Ga., Nebr., and Mont. (6); Calif. (8)

Heterodera marioni (Cornu) Goodey, root knot. (4)

Mycosphaerella columbi Rehm, leaf spot. Ohio (6)

M. plantaginicola (Cke.) Dearn. Pa. (4); N.Y. (5). Based on Sphaeria plantaginicola Schw., a pre-Friesian name. M. pachyasca (Rostr.) Vest., as reported in Me. and W.Va. (5) and N.Dak. (9), is perhaps rather to be referred here.

Pellicularia filamentosa (Pat.) Rogers, on leaf stalks. Ill. (5) See also Rhizoctonia solani

Peronospora alta Fckl., downy mildew. N.Car. to Ala., Tex. and Wis. (1); Wis. (2); Me. to N.J., Mo. and Wash. (5); N.Y. to Kans. and Wis. (6); also Mont., Tex., Alaska (9). The form on (1) is sometimes distinguished as P. plantaginis Underw.

Phoma polygramma (Fr.) Sacc. var. plantaginis Sacc., stem blight. N.J. (4)

Phomopsis subordinaria (Desm.) Trav., on flower stalks. Iowa (1); N.Y., Pa. (4). Said to be the conidial stage of Diaporthe arctii (Lasch) Nits.; appears identical with the preceding.

? Phyllachora plantaginis Ell. & Ev., leaf spot. Wis. (6)

Phyllosticta spp., leaf spot. The following are reported: P. atomata Tehon, Ill. (6); P. plantaginella Sacc., N.Y. (5); P. plantaginicola Tehon & Daniels, Ill. (3); P. plantaginis Sacc., Alaska (9).

Phymatotrichum omnivorum (Shear) Dug., root rot. Tex. (1,4,9)

Physarum cinereum (Batsch) Pers., slime mold on leaf and flower stalks. Frequent on (4) and (5) in the Eastern and Central States.

Puccinia aristidae Tracy (O,I), rust. Tex. (1,9); Colo. (7). II and III on Aristida and other grasses.

P. pacifica Blasd. (II,III), rust. Calif. (8?). O and I unknown.

Ramularia spp., leaf spot. R. plantaginis Ell. & Martin is reported

PLANTAGO cont.

on (5) from Me. to Miss., Nebr., and Minn., on (6) in Ind., N.Y., Wis.; on 1, 4, and 9 in Tex. R. plantaginis Pk. (renamed R. peckii Sacc. & Syd.) on (3) in Nebr., and on (4) in N.Y., Ore., and Wash., has priority. R. lanceolata Dearn. & House, perhaps not distinct from the latter, is reported on (4) in Calif., Mass., and N.Y.

Rhabdospora continua (Berk. & Curt.) Sacc., on flower stalks. Mich., Pa. (5). Cf. Phomopsis subordinaria

Rhizoctonia solani Kuehn, damping off, root rot. Ill. (1,4,5); Tex. (1,4,9)

Sclerotinia trifoliorum Eriks., root and stem rot. Ky., Ohio (4)

Sclerotium rolfsii Sacc., southern blight. Md. (6)

Septoria inconspicua Berk. & Br., on old leaves. Mo., Tex. (1); Okla. (2); N.J., Tex. (4); N.Y., ? Okla. (5)

S. plantaginea Pass., leaf spot. Wis. (2,5); Del., Va. (5)

Sphaceloma plantaginis Jenkins & Bitanc., spot anthracnose, scab. Me., Mass. (5); N.Y. to Md., Ill. and Wis. (6)

Sphaerotheca humuli (DC.) Burr. var. humuli (Schlecht.) Salm., powdery mildew. Wis. (5); Wyo. (7); N.J. (9)

Stigmatea plantaginis Tehon & Daniels, on old leaves. Ill. (3). Cf. Aphysa plantaginis.

Synchytrium plantagineum Sacc. & Speg., leaf gall. Pa., Tex. (3); Miss. (3,4)

Uromyces peckianus Farl. (0,I), rust. Frequent on (1) from Ind. to Tex. and Wis.; on (3) from S.Car. to Tex. and Ill.; on (7) from N.Dak. to Nebr. and Wash.; also Nebr., Okla., Tex. (2); and Mo. (6). II and III on Aristida and Distichlis spp.

Xanthomonas plantaginis (Thornberry & H. W. Anders.) Burkh., bacterial leaf spot. Ill.

Mosaic -- virus (Marmor tabaci var. plantaginis Holmes). Ky., N.J., Va. (4,5)

Yellows -- virus (Chlorogenus callistephi Holmes, Callistephus virus 1 K.M.Sm.). Pa. (5)

PLUMBAGINACEAE

ARMERIA

ARMERIA MARITIMA Willd., SEA-PINK, THRIFT. Perennial herb of the north Pacific Coast and Arctic regions, grown in rock gardens.

Uromyces limonii (DC.) Lév. var. armeriae (Schlecht.) Arth. (0,I,II, III), rust. Calif.

LIMONIUM (PLUMBAGINACEAE)

LIMONIUM spp., SEA-LAVENDER, STATICE (of gardens). Mostly perennial or biennial, sometimes woody herbs of Europe or Asia; several grown for ornament in rock gardens and some for cut flowers and everlastings, as L. LATIFOLIUM Kuntze (1); L. SINUATUM Mill. (2), other spp. (3). L. CALIFORNICUM (Boiss.) Small (4) of California, and L. CAROLINIANUM (Walt.) Britton (5) of salt meadows on the Atlantic and Gulf Coasts, are useful to wildlife.

Alternaria sp., leaf spot. Conn. (1)
Cercospora sp., leaf spot. Tex. (5)
Fusicladium staticis Ell. & Ev., leaf spot. Tex. (3)
Heterodera marioni (Cornu) Goodey, root knot. (2)
Phyllosticta sp., leaf spot. Conn. (1)
P. staticis Petr. N.Y. (5)
Phymatotrichum omnivorum (Shear) Dug., root rot. Tex. (3)
Uromyces limonii (DC.) Lév. (0,I,II,III), rust. Conn. (1); N.Mex., Tex. (3); Calif. (4); Me. to Miss. and Tex.(5)

Yellows -- virus (Chlorogenus callistephi var. californicus Holmes, Callistephus virus 1A K.M.Sm.). Calif. (4)

POLEMONIACEAE

COLLOMIA

COLLOMIA GRANDIFLORA (A. Gray) Dougl. (1), and C. LINEARIS Nutt. (2). Annual herbs of the Rocky Mountain region and Pacific States, sometimes grown for ornament.

Puccinia giliae Harkn. (II,III), rust. Calif., Wash. (1). 0 and I unknown.
P. plumbaria Pk. (0,I,III). Nev. (2)
Sphaerotheca humuli (DC.) Burr., powdery mildew. Calif. (1); Colo., Ida., Mont., N.Dak., Wash., Wyo. (2). Also the var. fuliginea (Schlecht.) Salm. in the same range (2)
Uromyces acuminatus Arth. var. polemonii (Pk.) J.J.Davis (0,I), rust. Colo., Nebr., N.Dak. (2). II and III on Spartina spp.

GILIA (POLEMONIACEAE)

GILIA spp., GILIA, SKYROCKET. Numerous annual to perennial herbs with showy flowers, mostly native to the Western States, especially California; several are cultivated for ornament or are useful to wildlife.

Heterodera marioni (Cornu)Goodey, root knot. Calif.

GILIA cont.

Phymatotrichum omnivorum (Shear) Dug., root rot. Tex.
Pratylenchus pratensis (DeMan) Filip., root nematode. Tex.
Puccinia aristidae Tracy (O,I), rust. Ariz., Colo.
P. giliae Harkn. (II,III). Ariz., Calif., Colo., Nev., Ore., Wash. O and I unknown.
P. plumbaria Pk. (O,I,III). Calif., Colo., Nev., Utah., Wyo.
P. yosemitana Blasd. (I,III). Calif., Colo.
Ramularia giliae Sprague, leaf spot. Ore. On G. bicolor Nutt.
Sphaerotheca humuli (DC.) Burr., powdery mildew. Calif., Tex., Wash.

Yellows -- virus (Chlorogenus callistephi var. californicus Holmes, Callistephus virus 1A K.M.Sm.) Calif.

MICROSTERIS (POLEMONIACEAE)

MICROSTERIS GRACILIS (Dougl.) Greene (1) and M. MICRANTHA (Kellogg) Greene (2). Annual herbs of the Rocky Mountain and Pacific States, useful to wildlife.

Peronospora phlogina Diet. & Holw., downy mildew. Ida. (1)
Puccinia plumbaria Pk. (O,I,III), rust. Mont. to Colo., Calif., and Wash. (1,2)
Sphaerotheca humuli (DC.) Burr., powdery mildew. Calif. (2); Wash. (1,2). Also the var. fuliginea (Schlecht.) Salm. in Mont. (1)

PHLOX (POLEMONIACEAE)

PHLOX spp. One annual, P. DRUMMONDII Hook. (1), and numerous perennial herbs, widely distributed in temperate N. America. Several are commonly cultivated for ornament as P. DIVARICATA L., WILD SWEET WILLIAM (2); P. PANICULATA L. (including horticultural forms and hybrids collectively termed P. decussata Hort.), SUMMER PERENNIAL PHLOX (3); and P. SUBULATA L., MOSS-PINK (4); others are occassionally cultivated or hybridized with cultigens as P. CAROLINA L. (P. suffruticosa Vent.) (5), P. MACULATA L. (6), P. PILOSA L. (7), and others (8)

Agrobacterium tumefaciens (E.F.Sm. & Town.) Conn, crown gall. N.J. (3)
Aphelenchoides fragariae (Ritz.-Bos) Christie, leaf nematode. Md. (1,3,5)
Ascochyta phlogis Vogl. var. phlogina Fairm., leaf spot. N.Y. (1) Mass., Tex. (3)
Botrytis cinerea Pers. ex Fr., gray mold. Alaska (3,8)
Cercospora omphakodes Ell. & Holw., leaf spot. N.Y. to Iowa and Wis.

PHLOX cont.

(2, ?3). Iowa (5); Okla., Wis. (7); Ala., W.Va. (8)

C. phlogina Pk. Minn., N.Y., Va. (3); Miss. (8)

Colletotrichum sp., stem canker. Fla. See also Pyrenochaeta and Vermicularia.

Ditylenchus dipsaci (Kuehn) Filip., leaf and stem nematode. Calif., Conn., Md., N.J., N.Y., Ohio, Wash. (3), Md. (4)

Erysiphe cichoracearum DC., powdery mildew. General (1,3) but resistance in some horticultural vars. is reported; Ind., N.Y., Ohio, Wis. (2); Mich. (6)

Heterodera marioni (Cornu) Goodey, root knot. Md. (1); Kans., Mass., N.J., Ohio, Tex., Wash. (3)

Leptosphaeria phlogis Oud. See Septoria phlogis

Lophodermium phloxii Bonar & W.B.Cooke, on leaves. Calif. (3)

Macrophoma cylindrospora (Desm.) Berl. & Vogl., leaf spot. Calif. (3)

Mycosphaerella sp. (Sphaerella phlogina Ell. & Ev.), on leaves. Mont., N.Y. (8)

Peronospora phlogina Diet. & Holw., downy mildew. Iowa, Wis. (2)

Phyllosticta sp., leaf spot. Wash. (3)

Phymatotrichum omnivorum (Shear) Dug., root rot. Tex. (3)

Puccinia douglasii Ell. & Ev. (O,I,III), rust. N.J., Pa. (4); Colo., Mont., Nebr., N.Mex., Ore., Utah, Wash., Wyo. (8)

P. plumbaria Pk. (O,I,III). Ill., Iowa, Mo. (2); Iowa, Tex. (7); Wyo. to N.Mex., Calif., and Wash. (8)

Pyrenochaeta phlogis (phloxidis) Massee, stem blight. N.Y. (3). See also Colletotrichum and Vermicularia.

Ramularia sp., leaf spot. Wash. (3)

Rhizoctonia solani Kuehn, stem rot. Minn., N.J., N.Y. (3)

Sclerotium rolfsii Sacc. (incl. S. delphinii Welch), southern blight, stem rot. Conn. (2); Md., N.J., N.Y., Ohio, Tex., Va. (3); Conn., Fla., Ill. (4)

Septoria spp., leaf spot. Not critically delimited but reported as follows: S. divaricata Ell. & Ev. in Ill.,N.Y., Wis., (2); Me. to Miss., Tex., and Wis. (3). S. drummondii Ell. & Ev. in Conn., Fla., Mich., Pa., Alaska (1). S. phlogis Sacc. & Speg. in N.Y. (1); Ind., Iowa, N.J., Wis. (2); Conn., Iowa, Mich., Nebr., N.J., W.Va. (3). Most authorities distinguish S. divaricata and S. phlogis. The reputed connection of the latter with Leptosphaeria phlogis has not been confirmed.

Sphaerotheca humuli (DC.) Burr., powdery mildew. Kans., N.H., N.Y., Ohio, Wash. (3)

Uromyces acuminatus Arth. var. polemonii (Pk.) J.J.Davis (O,I), rust. Iowa, Minn. (2); Iowa, Miss., Tex., (3); Ill., Iowa, S.Dak., Wis. (7)

Vermicularia phlogina Fairm., on old stems and leaves. Conn. (2,3); Md. (3); N.Y. (3,4); Miss., W.Va. (8). Perhaps not distinct from V. dematium Pers. ex Fr. (= Colletotrichum dematium (Fr.) Grove). See also Pyrenochaeta.

Verticillium albo-atrum Reinke & Berth., wilt. N.Y. (1,3); Minn. (5)

PHLOX cont.

Volutella phlogina Ell. & Langl., leaf spot. La. (3)

?Mosaic -- suspected virus. Md., N.Y., N.Car. (3)

Yellows -- virus (Chlorogenus callistephi Holmes; Callistephus virus 1 K.M.Sm.) Del., N.J., N.Y., Pa. (1); also var. californicus Holmes in Calif. (1).

Leaf drop -- blight -- cause unknown, believed to be primarily physiological though fungi -- Phoma, Pleospora, Vermicularia -- are often present as secondary agents; attributed in part to exhaustion of nutrients and production of new shoots on old stems. Frequent on (3) in Middle Atlantic States.

POLEMONIUM (POLEMONIACEAE)

POLEMONIUM spp. Perennial herbs; introduced, as P. CAERULEUM L., JACOBS LADDER, GREEK VALERIAN (1) of Europe; or native, as P. PULCHERRIMUM Hook. (2), of the Western States, and P. REPTANS L. (3) of the Eastern and South Central; other spp. (4). All are of ornamental value; (1) is most commonly cult.

Cercospora omphakodes Ell. & Holw., leaf spot. Pa. (3)
Erysiphe cichoracearum DC., powdery mildew. Utah (4)
Fusarium sp., wilt. N.J. (4)
?Phyllachora polemonii Harkn., on leaves. Calif. (2)
Puccinia gulosa Jacks. (III), rust. Calif. (2)
P. polemonii Diet. & Holw. (III). Ida., Ind. (3); Calif., Ida., Alaska (4)
Pyrenophora polyphragmoides Sacc. & Scalia, on dead stems and leaves. Alaska (2)
Septoria polemonii Thuem., leaf spot. Mo., Wis. (3)
S. polemoniicola Ell. & Martin. Conn., Ind., Mo. (3)
Sphaerotheca humuli (DC.) Burr., powdery mildew. Wash. (4)
Uromyces acuminatus Arth. var. polemonii (Pk.) J.J.Davis (O,I), rust. Ill., Ind., Iowa, Wis. (3)
Verticillium albo-atrum Reinke & Berth., wilt. N.Y. (4)

POLYGALACEAE

POLYGALA

POLYGALA spp., MILKWORT. Numerous native herbs, some of ornamental value, of the Eastern and Central States and southward, and also exotic shrubs grown for ornament mostly in the South and Calif. P. CRUCIATA L. (1), P. LUTEA L. (2), P. PAUCIFOLIA Willd. (3), and P. VIRIDESCENS L. (4) are representative of the herbaceous spp.; others (5)

POLYGALA cont.

Aecidium renatum Arth. (0,I), rust. N.Mex. (5)
Cercospora grisea Cke. & Ell., leaf spot. N.J. (1), Miss. (2,4), Va. (5)
Gloeosporium ramosum Ell. & Ev., anthracnose. Wis. (5,6); Ind., N.J.(5)
Phoma polygalae Cke. & Harkn., on stems. Calif. (6)
Phomatospora berkeleyi Sacc., on stems. Calif. (6)
?Phyllachora polygalae (Schw.) Sacc., on leaves. Fla. (5)
Puccinia andropogonis (Schw.) var. polygalina [Pk.] Arth. (0,I). Iowa, Mich., Wis. (5). II and III on Andropogon spp.
P. pyrolae Cke. (III), rust. Conn., Me., Mich., Minn., N.H., N.Y., Wis. (3)
Septoria consocia Pk., leaf spot. Ind., Mich. (5)
S. polygalae Pk. & G.W.Clint. N.Y. (3)

SECURIDACA (POLYGALACEAE)

SECURIDACA spp. Tropical American shrubs and vines, sometimes grown for ornament.

Morenoella whetzelii Toro, black mildew. P.R.
Phyllachora perforans (Rehm) Sacc. & Syd., and P. securidaceae P. Henn., on leaves. P.R.

POLYPODIACEAE

ADIANTUM

ADIANTUM PEDATUM L. (1), other spp. (2), MAIDENHAIR FERN. Ferns of tropical America or other warm regions (2), or native to the United States (1,2), the former grown in conservatories or sometimes as house plants, the latter in wild gardens.

Desmella superficialis (Speg.) Syd. (II,III), rust. P.R. (2). O and I unknown.
Meliola pteridicola F.L.Stevens, black mildew. Canal Zone, P.R. (2)
Micropeltis marattiae P.Henn., on leaves. P.R.(2)
Mycosphaerella sp. (Sphaerella pteridis (Desm.) DeNot.), leaf spot. Fla. (2)
Pezizella aspidiicola (Berk. & Br.) Rehm, on rhizomes. Mich. (1)
Phyllosticta adianticola E.Young, leaf spot. P.R. (2)

ASPLENIUM (POLYPODIACEAE)

ASPLENIUM NIDUS L., BIRDS-NEST FERN (1); other spp., SPLEENWORT (2). Mostly tropical (1,2) and several native (2) ferns, the former especially grown in conservatories.

ASPLENIUM cont.

Aphelenchoides olesistus (Ritz.-Boz) Steiner & Buhrer, leaf nematode. Conn., N.J., N.Y., Pa. (1)

Cercospora sp., leaf spot. Fla. (2)

ATHYRIUM (POLYPODIACEAE)

ATHYRIUM FILIX-FEMINA (L.) Roth, LADY-FERN (1); A. THELYPTEROIDES (Michx.) Desv., silvery spleenwort (2); other spp. (3). Hardy ferns, (1) in many forms widely distributed in the U.S. and the source of numerous horticultural vars., (2) and (3) in the Eastern and South CentralStates, and some in the far North.

Botrytis cinerea Pers. ex Fr., gray mold. Alaska (3)

Septoria asplenii Ell. & Ev., leaf spot. Mich. (3)

Uredinopsis copelandii Syd. (II,III), rust. Calif. On A. cyclosorum Rupr., var. of (1) or closely related. O and I unknown.

U. longimucronata Faull (II,III). Me. to Pa. and Wis. On A. angustum (Willd.) Presl, var. of (1) or closely related. O and I on Abies balsamea.

U. longimucronata f. cyclosora Faull (II,III). Calif., Ida., Mont., Ore., Wash., Alaska. On A. cyclosorum. O and I on Abies lasiocarpa.

U. longimucronata var. acrostichoides Faull (II,III). N.H., N.Y., Wis. (2)

BLECHNUM (POLYPODIACEAE)

BLECHNUM GIBBUM Mett. (1), B. OCCIDENTALE L. (2). Tropical ferns suitable for greenhouse culture.

Aphelenchoides olesistus (Ritz.-Bos) Steiner & Buhrer, leaf nematode. (1)

Milesia australis Arth. f. irregularis Faull (II,III), rust. P.R. (2). O and I unknown.

Mycosphaerella filicum (Desm.) Schroet., on leaves. Fla.

CAMPTOSORUS (POLYPODIACEAE)

CAMPTOSORUS RHIZOPHYLLUS (L.) Link, WALKING-FERN. Hardy fern of the Eastern and Southern States, sometimes grown in rock gardens.

Cercospora camptosori J.J.Davis, leaf spot. Wis.

CRYPTOGRAMMA (POLYPODIACEAE)

CRYPTOGRAMMA spp., ROCK-BRAKE, PARSLEY-FERN. Small ferns of northern and western U.S., sometimes used in rock gardens.

Hyalopsora cheilanthis (Pk.) Arth. (II,III), rust. Iowa, Mich.,

CRYPTOGRAMMA cont.
Mont., Wis. O and I unknown.
Milesia darkeri Faull (II,III), rust. Calif., Ore. O and I unknown.

CYRTOMIUM (POLYPODIACEAE)

CYRTOMIUM FALCATUM Presl, HOLLY-FERN. Tropical fern often grown in conservatories and as a house plant.

Botrytis cinerea Pers. ex Fr., gray mold. Alaska.
Completoria complens Lohde, damping off of prothallia. N.Y.

CYSTOPTERIS (POLYPODIACEAE)

CYSTOPTERIS BULBIFERA Bernh., BLADDER-FERN (1); C. FRAGILIS Bernh., BRITTLE-FERN (2). Small rock-ferns of moist cliffs and banks nearly throughout the U.S.; used in rock and wild gardens.

Hyalopsora polypodii (DC.) Magn. (II,III), rust. General in the Northern and Western States (2). O and I unknown.
Omphalia flavida (Cke.) Maubl. & Rang., on leaves. P.R. (2)
Uredinopsis ceratophora Faull (II,III), rust. Ind., N.Y., Wis. (1). O and I unknown.
U. glabra Faull (II,III). N.Mex. (2)

DRYOPTERIS (POLYPODIACEAE)

DRYOPTERIS spp., WOODFERN, SHIELDFERN. Mostly hardy ferns, several widely distributed in the Northern and Western States, others southern or tropical; often grown in wild gardens and conservatories. Representative spp.: D. DISJUNCTA (D. linnaeana C. Chr.), OAK-FERN (1); D. FILIX-MAS (L.) Schott., MALE-F. (2); D. MARGINALIS (L.) A. Gray, LEATHER WOODFERN (3); D. PHEGOPTERIS (L.) C. Chr., NARROW BEECH-FERN (4); D. SPINULOSA (Müll.) O. Kuntze, TOOTHED W. (5); D. THELYPTERIS (L.) A. Gray, MARSH-FERN (6); others (7).

Aphelenchoides olesistus (Ritz-Bos) Steiner & Buhrer, leaf nematode.
Cryptomycina pteridis (Rebent. ex Fr.) Hoehn., tar spot. Wis. (3)
Cylindrocladium pteridis Wolf, brown leaf spot. Fla. (7)
Desmella superficialis (Speg.) Syd. (II,III), rust. P.R. (7). O and I unknown.
Hyalopsora aspidiotus (Pk.) Magn. (II,III), rust. Me. to N.Car., Wis., and Wash. (1). O and I on Abies balsamea.

DRYPOTERIS cont.

Leptostromella filicina (Berk. & Curt.) Sacc., on leaf stalks. W.Va. (5)

Milesia dilatata Faull (II,III), rust. Ore. (7). O and I unknown.

M. fructuosa Faull (II,III). Me., Mass., N.H., N.Y., Vt. (5) and vars. or closely related spp. O and I on Abies balsamea.

M. marginalis Faull & W.R.Wats. (II,III). Mass., N.H., N.Y. (3). O and I on Abies balsamea.

Taphrina californica Mix, leaf blister. Calif. (7)

T. filicina Rostr. N.Y., Pa. (5)

T. lutescens Rostr. Wis. (6)

Uredinopsis atkinsonii Magn. (II,III), rust. Me. to Miss., Nebr., and N.Dak. (6), var. pubescens (Lawson) Prince. O and I on Abies balsamea

U. phegopteris Arth. (II,III). Me., N.H., Wis. (1). O and I on Abies balsamea.

NEPHROLEPIS (POLYPODIACEAE)

NEPHROLEPIS EXALTATA (L.) Schott., SWORD-FERN, BOSTON F. especially the var. BOSTONIENSIS, (1); other spp. (2). Tropical ferns, widely grown for ornament, especially (1) in numerous horticultural vars. as a house plant.

Botrytis cinerea Pers. ex Fr., gray mold. Alaska (1)

Cercospora sp., leaf spot. Ind. (1)

Cylindrocladium pteridis Wolf, leaf spot. Fla. (1)

Glomerella nephrolepis Faris (?G. cingulata (Ston.) Spauld. & Schrenk), anthracnose, tip blight. N.Y., Ohio (1)

Milesia insularis Faull (II), rust. P.R. (2)

Phyllosticta sp., leaf spot. ?N.Y.

Rhizoctonia ?solani Kuehn, damping off. Fla. (1)

ONOCLEA (POLYPODIACEAE)

ONOCLEA SENSIBILIS L., SENSITIVE FERN. Hardy fern of the Eastern and Central States and southward, sometimes grown in wild gardens.

Cuscuta gronovii Willd., dodder. N.Y.

Taphrina filicina Rostr., leaf blister.

Uredinopsis mirabilis (Pk.) Magn. (II,III), rust. Me. to Va., Nebr. and Minn.; P.R. O and I on Abies balsamea.

PELLAEA (POLYPODIACEAE)

PELLAEA spp., CLIFF-BRAKE. Rock ferns, mostly of western U.S., sometimes grown in conservatories.

Hyalopsora cheilanthis (Pk.) Arth. (II,III), rust. Calif., Tex. O and I unknown.

POLYPODIUM (POLYPODIACEAE)

POLYPODIUM spp., POLYPODY. Numerous widely distributed native ferns, often on walls or epiphytic, and also tropical spp. grown in conservatories. Representative spp.: P. AUREUM L., HARE'S-FOOT F. (1); P. POLYPODIOIDES (L.) Hitchc., RESURRECTION F. (2); P. VIRGINIANUM L. (3) of Eastern U.S., and P. VULGARE L. (4) of western U. S. and frequent in cultivation; others (5)

Acrospermum maxoni Farl., leaf mold. Canal Zone. (5)
Alternaria polypodii Major (?A. tenuis Nees ex Cda.), leaf spot (? secondary). ?N.Y. (4)
Aphelenchoides olesistus (Ritz.-Bos) Steiner & Buhrer, leaf nematode. (1,4,5)
Cercospora phyllitidis Hume, leaf spot. Fla., P.R. (5)
Milesia laeviuscula (Diet. & Holw.) Faull (II,III), rust. Calif. (5); also f. glycyrrhiza Faull on P. glycyrrhiza D.C.Eaton in Ore., Wash., and Alaska. O and I unknown.
M. polypodophila (Bell) Faull (II,III). Conn., Me., Mass., N.H., N.Y., Pa., Tenn., Vt. (3)
Phyllosticta sp., leaf spot. Va. (3)
Calliciopsis maxima (Berk. & Curt.) Hoehn., parasitic in sori. P.R. (5)

POLYSTICHUM (POLYPODIACEAE)

POLYSTICHUM ACROSTICHOIDES (Michx.) Schott,, CHRISTMAS FERN (1); P. ADIANTIFORME J. Sm., LEATHER HOLLY-FERN (2); P. MUNITUM (Kaulf.) Presl, GIANT H., PACIFIC CHRISTMAS F. (3). Hardy native (1,3) or tropical (2) ferns, commonly used for greenery in floriculture.

Aphelenchoides olesistus (Ritz.-Bos) Steiner & Buhrer, nematode leaf spot. Ore. (3)
Cylindrocladium pteridis Wolf, leaf spot. Fla. (2)
Ditylenchus dipsaci (Kühn) Filip., nematode leaf spot. Ore. (3)
Milesia polystichi Wineland (II,III), rust. Ida., Mont., Ore., Wash. (3). O and I unknown.

POLYSTICHUM cont.

M. vogesiaca (Syd.) Faull (II,III). Ore. (3)
Pezizella pteridina (Nyl.) Rehm, on leaf stalks. Calif. (3)
Taphrina faulliana Mix, leaf blister. Ore. (3)
T. filicina Rostr. (Me., Md., N.Y., N.Car., Va., Wis.)
Trabutiella filicina (Sacc. & Scalia) Theiss. & Syd., tar spot. Alaska. On P. lonchitis (L.) Roth.

PTERETIS (POLYPODIACEAE)

PTERETIS NODULOSA (Michx.) Neuwl., AMERICAN OSTRICH-FERN. Hardy fern of the Northeastern and Great Lakes States, sometimes grown in wild gardens.

Taphrina struthiopteridis Nishida, leaf blister. Wis.
Uredinopsis struthiopteridis Störmer (II,III), rust. N.Y., Vt., Wis. C and I on Abies balsamea.

PTERIDIUM (POLYPODIACEAE)

PTERIDIUM AQUILINUM (L.) Kuehn, BRACKEN. Hardy fern of cosmopolitan distribution, dominant plant in many seacoast and upland regions; sometimes a weed in cultivated ground but useful to wildlife. The form in the Northeastern States to N.Car. and Tenn. is var. latiusculum (1); in the Southeastern States var. pseudocaudatum (2); in the Northwest, Calif. and Tex. var. pubescens Underw., (3); P. CAUDATUM (L.) Maxon (4) occurs in Fla. and the West Indies.

Catacauma flabellum (Schw.) Theiss. & Syd., black mildew, tar spot (typically on upper surface and following veins). Md., N.J., Pa., Tenn., W.Va., Wis. (1); Ga., S.Car. (2)
Cryptomycina pteridis (Rebent. ex Fr.) Hoehn., tar spot, or when systemic causing leaf-roll disease (typically on lower surface and interveinal). Me. to N.Car., Iowa and Wis. (1); Ala., Ga., Miss. (2); Calif., Ida., Mont., Ore., Wash., Alaska (3). Usually reported under the numerous conidial names as Gloeosporium pteridis Harkn., G. necans Ell. & Ev., G. leptospermum Pk., G. obtegens Syd.; also Ascochyta necans (Ell. & Ev.) J.J.Davis, Marssonina necans (Ell. & Ev.) Magn., and Cylindrosporium aquilinum (Pass.) Gilman & Archer.
(Leptostroma filicinum Fr.): Rhopographus filicinus. Calif., Me.
L. litigiosum Desm., on leaf stalks. N.Y. (1); Calif., Wash. (3). Conidial stage of Microthyrium litiginosum Sacc.
L. pteridis Ehr. (? Thyriostroma pteridis Died.), on leaves. Me. (1)
Leptostromella filicina (Berk. & Curt.) Sacc. (L. pteridina Sacc. & Roum.), on leaf stalks. Mich.

PTERIDIUM cont.

Mycosphaerella spp., on old leaves or stalks. The following are reported: M. indistincta (Pk.) Lindau, and M. pteridicola Dearn. & House in N.Y. (1); Sphaerella pteridis (Desm.) DeN. in Mass. (1); Calif. (3)

Phyllosticta pteridis Halst., leaf spot. Me., N.J.

Rhizoctonia sp., scurf, ?canker, on leaf stalks. Ore. (3)

Rhopographus filicinus (Fr.) Nits. ex Fckl., on dead leaf stalks. Me., N.J., N.Y. (1); Calif. (3); probably general.

Septoria aquilina Pass., S. pteridis Pk. See Cryptomycina

Uleodothis pteridis F.L.Stevens, leaf spot. P.R. (3)

Uredinopsis aspera Faull (II,III), rust. Calif., Hawaii (3)

U. macrosperma (Cke.) Magn. (II,III). Ala., Fla., Ga., Miss. (2); Calif., Ida., Mont., N.Mex., Ore., Wash. (3); Fla., Ga., Canal Zone (4)

U. virginiana Faull (II,III). N.Y. to N.Car. and Tenn. (1); Ga. to Tex. (2)

PTERIS (POLYPODIACEAE)

PTERIS CRETICA L. (1), P. SERRULATA L. f. (2), other spp. (3), BRAKE. Tropical ferns, usually grown in conservatories, or in the open, especially (2), in the Gulf States.

Aphelenchoides olesistus (Ritz.-Bos) Steiner & Buhrer, nematode leaf spot. Conn., N.J., N.Y. (1,2,3)

Completoria complens Lohde, damping off of prothallia. N.Y. (1,3)

Phyllosticta pteridis Halst., tip blight. Miss., N.J. (1)

Pythium intermedium DBy., damping off. N.Y. (1,3)

WOODSIA (POLYPODIACEAE)

WOODSIA GLABELLA R. Br. (1), W. SCOPULINA D.C.Eaton (2). Small rock-ferns of the Northern Border States, sometimes grown in rock gardens.

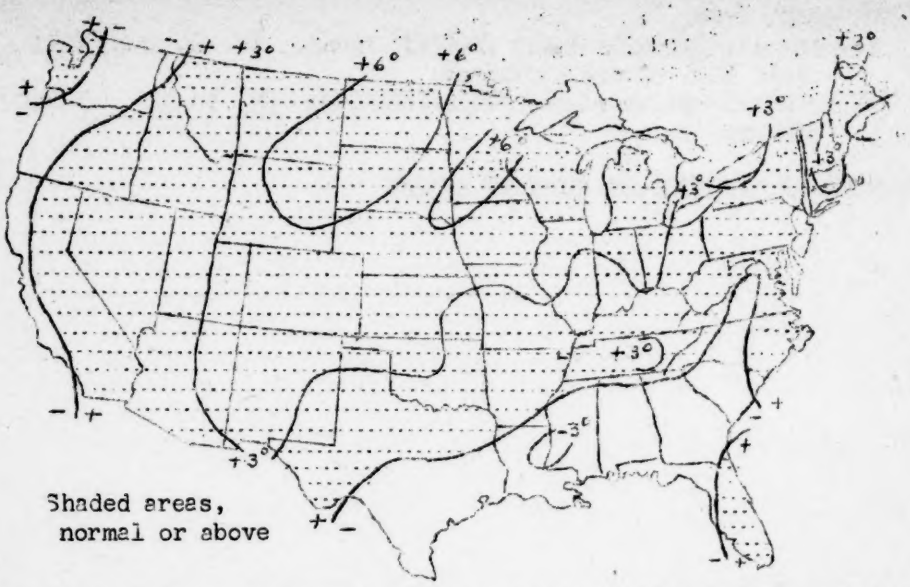
Hyalopsora polypodii (DC.) Magn. (II,III), rust. Mich. (1), Ida. (2). C and I unknown.

WOODWARDIA (POLYPODIACEAE)

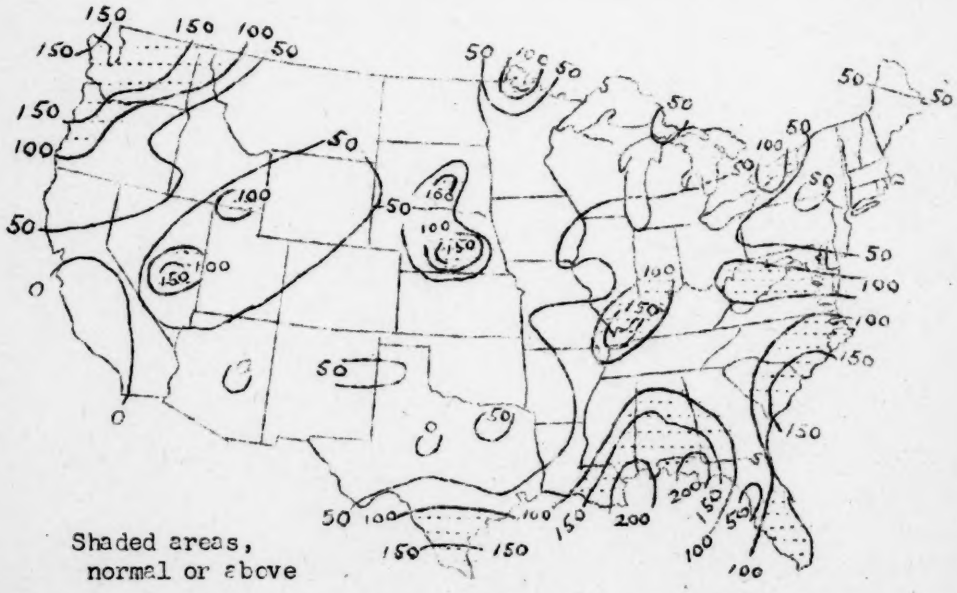
WOODWARDIA AREOLATA (L.) Moore (1), W. VIRGINICA (L.) J.E.Sm. (2), CHAIN-FERN. Coarse ferns of swamps or ponds in the Eastern and Gulf States, sometimes grown in wild gardens.

WOODWARDIA cont.
Uredinopsis arthurii Faull (II,III), rust. Vt. to Ala., Ind., and Mich. (2). O and I unknown.
U. arthurii var. maculata Faull (II,III). Me. to Ala. O and I unknown.

DIVISION OF MYCOLOGY AND DISEASE SURVEY



Map I. Departure of mean temperature from normal September, 1948



Map II. Percentage of normal precipitation, September, 1948

SEPTEMBER WEATHER

From U. S. Department of Commerce, Weather Bureau, Weekly Weather and Crop Bulletin for week ending October 5, 1948.